PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NGK SPARK PLUG CO LTD

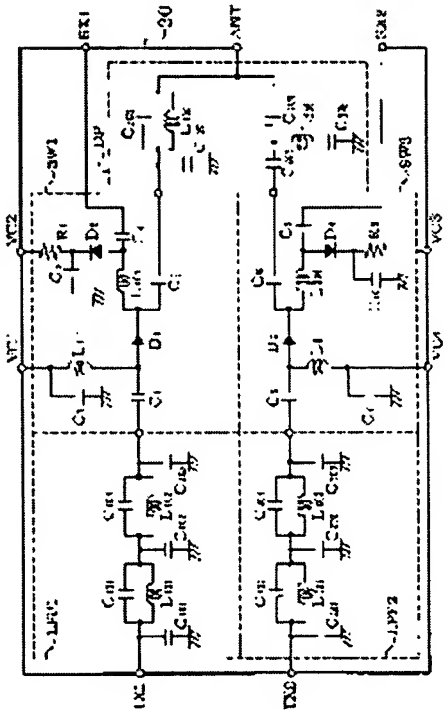
(72)Inventor : HAYAKAWA TOSHITAKA

(54) ANTENNA SWITCH MODULE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an antenna switch module that contributes to downsizing and weight reduction without losing the stability of operation of a mobile communication unit.

SOLUTION: Since an antenna switch 20 requires no external provision of a diplexer DP and coupling capacitors C3, C8, the mount area of a dual bind unit 100 on which the antenna 20 is mounted can be reduced. Furthermore, since the coupling capacitors C3, C8 can be properly changed and the impedance matching between switch circuits SW1, SW2 of the antenna switch 20 single body and the diplexer DP can properly be taken, the high frequency characteristic of the dual band unit 100 can be stabilized. Accordingly, the antenna switch 20 contributes to downsizing and weight reduction without losing the stability of the operation of the dual band unit 100 coping with different frequency bands.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the antenna switch module equipped with the switching circuit which switches the signal path which connects between a signal path, and the antennas and receiving circuits which are connected to the sending circuit, receiving circuit, and antenna of mobile communication equipment (for example, a portable telephone, a personal handy phone machine, etc.), and connect between an antenna and sending circuits.
[0002]
[Description of the Prior Art] Since the allocation partition of a radio frequency band may change with differences in a country or an area while the mobile communication equipment which makes representation a portable telephone and a personal handy phone machine (the so-called PHS) spreads globally in recent years, the available radio frequency band of mobile communication equipment may be different for every country and area.
[0003] what is depended on a GSM (Global System for Mobile communication) method in Europe while the 800MHz band and the 1.5GHz band are assigned to what is depended on a PDC (PersonnalDigital Celler) method in our country in the case of the portable telephone for example, by the digital method -- a 900MHz band -- moreover, DCS (Digital Cellular System) The 1.8GHz band is assigned to what is depended on a method, respectively. Furthermore, the 800MHz band and the 1.9GHz band are assigned in the U.S. to what is depended on IS(Interim Standard)-54,136 method, respectively.
[0004] Thus, the allocation partition of a radio frequency changes with differences in a country or an area, and also there is the actual condition classified into two or more frequency bands into the same country or the area like our country or Europe. Therefore, even if it is one set of a portable telephone, for example, is different frequency band and communication modes, such as a GSM method of a 900MHz band, and a DCS method of a 1.8GHz band, the portable telephone (henceforth a "dual band machine") of a dual band specification which can respond to both sides is developed and produced commercially. And the appearance of the portable telephone of a multi-band specification which can be equivalent also to three or more different frequency bands is also expected from now on.
[0005] Even if it is in the inside where dual band-ization of such a portable telephone progresses on the other hand, the demand of the formation of small lightweight to a portable telephone is still high. Therefore, in a portable telephone manufacturer or its components manufacturer, the attempt to small-and-light-izing on components level is made by reduction of components mark, or minimum-ization of each functional module size. The present condition is the modularization especially of functional block and the unit which were conventionally constituted with discrete part being carried out to high density by ultra-fine processing technology, such as integration and lamination, and mounted in a printed circuit board etc. as single components.
[0006] For example, it connected with the sending circuit, the receiving circuit, and the antenna, and in the antenna switch module which switches between antennas and these circuits, another components constituted the filter circuit which removes an unnecessary RF signal component in the preceding paragraph or latter part, and it was conventionally established in it. However, in the antenna switch module integrated and laminated by the request of small-and-light-izing which was mentioned above, it is going to contribute to the further formation of small lightweight of a portable telephone, or reduction of components mark by building in such a filter circuit.
[0007]
[Problem(s) to be Solved by the Invention] However, although the filter circuit which should be established in the preceding paragraph or latter part is built in according to such an antenna switch module, the capacitor formed among both is used as the external component. That is, the configuration in which an antenna switch module forms independently the coupling capacitor aiming at the removal of a dc component used as the driver voltage of a switching circuit and adjustment of an impedance outside is taken. Therefore, though the magnitude of the antenna switch module itself can be miniaturized more, since it must form a coupling capacitor separately as an external component, it must

prepare the mounting field of the coupling capacitor made into the printed circuit board side of the portable telephone which mounts an antenna switch module external according to an individual. Therefore, since it will keep away from reduction of the part from which this coupling capacitor becomes external, and components mark, or reduction of a component-side product, there is a problem that it can become the hindrance to the formation of small lightweight of a portable telephone.

[0008] Moreover, since a coupling capacitor also has the role which takes the impedance matching other than the role which removes a dc component, it cannot take suitable impedance matching depending on the degree of the capacity error or variation, but also has a possibility of becoming increase of an insertion loss, and the destabilizing factor of a RF property. That is, since it can become loss of a transceiver signal, and the hindrance of operational stability by the variation in the value of the coupling capacitor by which external is carried out etc., there is a problem that it may lead to substantial contraction-ization of the range which can be talked over the telephone.

[0009] The place which it is made in order that this invention may solve the technical problem mentioned above, and is made into the purpose is to offer the antenna switch module which can contribute to small lightweight-ization, without spoiling the stability of actuation of mobile communication equipment.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in the antenna switch module of claim 1 It is the antenna switch module equipped with the switching circuit which switches the signal path which connects between the signal path which is connected to a sending circuit, a receiving circuit, and an antenna, and connects between said sending circuits with said antenna, and said antennas and said receiving circuits. The receiving terminal connected to the antenna terminal connected to said antenna, the transmitting terminal connected to said sending circuit, or said receiving circuit either The filter circuit which intervenes between a terminal and said switching circuit and removes an unnecessary RF signal component, It makes into a technical feature to be placed between a serial and to equip the signal path which connects between said filter circuits and said switching circuits with the capacitor which can be changed.

[0011] In order to attain the above-mentioned purpose, moreover, in the antenna switch module of claim 2 It is the antenna switch module equipped with the switching circuit which switches the signal path which connects between the signal path which is connected to a sending circuit, a receiving circuit, and an antenna, and connects between said sending circuits with said antenna, and said antennas and said receiving circuits. The transmitting-side filter circuit which intervenes between the transmitting terminal connected to said sending circuit, and said switching circuit, and removes an unnecessary RF signal component, The antenna side filter circuit which intervenes between the antenna terminal connected to said antenna, and said switching circuit, and removes an unnecessary RF signal component, It is placed between the signal path which connects between said transmitting-side filter circuits and said switching circuits at a serial. The transmitting-side capacitor which can be changed, It makes into a technical feature to be placed between a serial at the signal path which connects between said antenna side filter circuit and said switching circuits, and to have the antenna side capacitor which can be changed, and **.

[0012] Furthermore, in the antenna switch module of claim 3, in claim 2, it intervenes between the receiving terminal connected to said receiving circuit, and said switching circuit, is placed between a serial at the signal path which connects between the receiving-side filter circuit which removes an unnecessary RF signal component, and said receiving-side filter circuits and said switching circuits, and makes into a technical feature to have the receiving-side capacitor which can be changed.

[0013] In order to attain the above-mentioned purpose, in the antenna switch module of claim 4 The switching circuit which switches the signal path which connects between the signal path which is connected to an antenna, two or more sending circuits, and a receiving circuit, and connects between said antenna and the sending circuits of one of said two or more sending circuits, and said antennas and the receiving circuits of one of said two or more receiving circuits It is the antenna switch module which it had corresponding to two or more of said sending circuits and receiving circuits. It intervenes between the antenna terminal and said two or more switching circuits which are connected to said antenna. The synthetic separation circuit which compounds the sending signal outputted from the sending circuit of the arbitration of said two or more sending circuits, or the input signal inputted into the receiving circuit of the arbitration of said two or more receiving circuits, or is separated, It makes into a technical feature to be placed between a serial and to equip the signal path which connects between said synthetic separation circuit and said two or more switching circuits with the capacitor which can be changed.

[0014] Moreover, in the antenna switch module of claim 5, in claim 4, it intervenes between two or more transmitting terminals and said two or more switching circuits which are connected to said two or more sending circuits, is placed between a serial at two or more signal paths which connect between two or more transmitting-side filter circuits which remove an unnecessary RF signal component, and said two or more transmitting-side filter circuits and said two or more switching circuits, and makes into a technical feature to have two or more transmitting-side capacitors which can

be changed.
[0015] Furthermore, in the antenna switch module of claim 6, in claim 4, it intervenes between two or more receiving terminals and said two or more switching circuits which are connected to said two or more receiving circuits, is placed between a serial at two or more signal paths which connect between two or more receiving-side filter circuits which remove an unnecessary RF signal component, and said two or more receiving-side filter circuits and said two or more switching circuits, and makes into a technical feature to have two or more receiving-side capacitors which can be changed.
[0016] either of the receiving terminals connected to the antenna terminal connected to an antenna, the transmitting terminal connected to a sending circuit, or a receiving circuit in invention of claim 1 -- a filter circuit intervenes between the switching circuit which switches the signal path which connects between a terminal, the signal path and the antenna which connects between sending circuits with an antenna, and receiving circuits, and **, and the capacitor which can change into the signal path which connects between this filter circuit and switching circuit at a serial intervenes. That is, between a sending circuit, a receiving circuit, or an antenna and a switching circuit, the filter circuit which removes an unnecessary high frequency signal component intervenes, and the capacitor which can be changed into a serial intervenes between this filter circuit and switching circuit further. Thereby, since it is not necessary to form a filter circuit and a capacitor concerned in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the capacitor concerned is an antenna switch module simple substance and can take the impedance matching of a switching circuit and a filter circuit appropriately the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment.
[0017] In invention of claim 2, a transmitting-side filter circuit intervenes between the switching circuit which switches the signal path which connects between the transmitting terminal connected to a sending circuit, the signal path and antenna which connect between sending circuits with an antenna, and receiving circuits, and **, and the transmitting-side capacitor which can be changed into the signal path which connects between this transmitting-side filter circuit and switching circuit at a serial intervenes. Moreover, an antenna side filter circuit intervenes between the antenna terminal connected to an antenna, and the switching circuit concerned, and the antenna side capacitor which can be changed into the signal path which connects between this antenna side filter circuit and switching circuits at a serial intervenes. That is, between the transmitting-side filter circuit which removes an unnecessary high frequency signal component between a sending circuit and a switching circuit, and an antenna and a switching circuit, the antenna side filter circuit which removes an unnecessary high frequency signal component intervenes, and the transmitting-side capacitor which can be changed into a serial, and an antenna side capacitor intervene further, respectively between these transmitting-side filter circuits, an antenna side filter circuit, and a switching circuit. Thereby, since it is not necessary to form these transmitting-side filter circuits, an antenna side filter circuit, a transmitting-side capacitor, and an antenna side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since these transmitting-side capacitors and an antenna side capacitor are antenna switch module simple substances and can take appropriately the impedance matching of a switching circuit, and a transmitting-side filter circuit and an antenna side filter circuit the place which can be changed suitably, they can make stability the RF property by the side of mobile communication equipment.
[0018] In invention of claim 3, in addition to invention of claim 2, a receiving-side filter circuit intervenes between the receiving terminal connected to a receiving circuit, and the switching circuit concerned, and the receiving-side capacitor which can be changed into the signal path which connects between this receiving-side filter circuit and switching circuit at a serial intervenes. That is, between a receiving circuit and a switching circuit, the receiving-side filter circuit which removes an unnecessary RF signal component intervenes, and the receiving-side capacitor which can be changed into a serial intervenes between this receiving-side filter circuit and switching circuit. Thereby, since it is not necessary to form these transmitting-side filter circuits, a receiving-side filter circuit, an antenna side filter circuit, a transmitting-side capacitor, a receiving-side capacitor, and an antenna side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are further reducible. Moreover, since these transmitting-side capacitors, a receiving-side capacitor, and an antenna side capacitor are antenna switch module simple substances and can take appropriately the impedance matching of a switching circuit, and a transmitting-side filter circuit, a receiving-side filter circuit and an antenna side filter circuit the place which can be changed suitably, they can make stability further the RF property by the side of mobile communication equipment.
[0019] In invention of claim 4, a synthetic separation circuit intervenes between two or more switching circuits which switch the signal path which connects between the signal path and antenna which connect between the antenna terminal connected to an antenna, and an antenna and two or more sending circuits, and two or more receiving circuits, and **, and the capacitor which can be changed into the signal path which connects between this synthetic separation circuit

and two or more switching circuits at a serial intervenes. That is, between an antenna and two or more switching circuits, the synthetic separation circuit which compounds the input signal inputted into the receiving circuit of the sending signal outputted from the sending circuit of arbitration or arbitration, or is separated intervenes, and the capacitor which can be changed into a serial intervenes between this synthetic separation circuit and two or more switching circuits further. Thereby, since it is not necessary to form a synthetic separation circuit and a capacitor concerned in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment.

[0020] In invention of claim 5, in addition to invention of claim 4, a transmitting-side filter circuit intervenes between two or more transmitting terminals and two or more switching circuits concerned which are connected to two or more sending circuits, and the transmitting-side capacitor which can be changed into the signal path which connects between this transmitting-side filter circuit and two or more switching circuits at a serial intervenes. That is, between two or more sending circuits and two or more switching circuits, the transmitting-side filter circuit which removes an unnecessary RF signal component intervenes, and the transmitting-side capacitor which can be changed into a serial intervenes further between this transmitting-side filter circuit and two or more switching circuits. Thereby, since it is not necessary to form the transmitting-side filter circuit concerned and a transmitting-side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the transmitting-side capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment.

[0021] In invention of claim 6, in addition to invention of claim 4, a receiving-side filter circuit intervenes between two or more receiving terminals and two or more switching circuits concerned which are connected to two or more receiving circuits, and the receiving-side capacitor which can be changed into the signal path which connects between this receiving-side filter circuit and two or more switching circuits at a serial intervenes. That is, between two or more receiving circuits and two or more switching circuits, the receiving-side filter circuit which removes an unnecessary RF signal component intervenes, and the receiving-side capacitor which can be changed into a serial intervenes further between this receiving-side filter circuit and two or more switching circuits. Thereby, since it is not necessary to form the receiving-side filter circuit concerned and a receiving-side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the receiving-side capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment.

[0022]

[Embodiment of the Invention] Hereafter, the antenna switch module (henceforth an "antenna switch" in the gestalt of implementation of invention) of this invention is explained with reference to drawing 1 - drawing 9 about 1 operation gestalt applied to the dual band machine. In addition, the dual band machine taken up with this operation gestalt points out the portable telephone which can respond to the both sides of the GSM method of for example, a 900MHz band, and the DCS method of a 1.8GHz band.

[0023] First, the configuration of the dual band machine 100 which applied the antenna switch 20 concerning this operation gestalt is explained based on drawing 2 . The dual band machine 100 shown in drawing 2 is equipped with the transceiver section 101 by the GSM method, and the transceiver section 102 by the DCS method as the wireless section, and also it has the antenna switch 20 which receives one antenna 103 and uses as it a high frequency signal with the radio frequency band which changed with each methods. In addition, this wireless section is set as the specification which uses a 1710-1785MHz band for the communication link frequency of a GSM method at the communication link frequency of a 880-915MHz band and a DCS method. Moreover, although not shown in drawing 2 , this dual band machine 100 has the power supply section which consists of a control section constituted by the digital circuit centering on a microcomputer other than the wireless section concerned, a rechargeable battery, a power circuit, etc.

[0024] GSM transmitting section 160a by the transceiver section 101 The voltage-controlled oscillator which can generate the RF of wireless transmit frequencies (880-915MHz band) (it is called "VCO for transmission" below.) Mixer 163a which mixes with the source signal inputted from the RF signal generated from 162a and this VCO162a for transmission, the GSM modulator, etc., and is outputted, The low pass filter which removes a frequency component

higher than wireless transmit frequencies (915MHz band) from the output of transmitting amplifier 166a which carries out power amplification of this mixer output, and this transmitting amplifier 166a (it is called "LPF" below.) It consists of 168a etc. And the high frequency signal (GSM method) outputted from this GSM transmitting section 160a can be distributed to an antenna 103 side, and is emitted to space from an antenna 103 by the switching circuit and diplexer of the antenna switch 20 concerning this invention.

[0025] On the other hand, the diplexer and switching circuit of the antenna switch 20 can distribute the high frequency signal by the GSM method received with the antenna 103 to the GSM receive section 170a side. Band-pass filter (henceforth "BPF") 171a in which this GSM receive section 170a permits passage of a required frequency component, The voltage-controlled oscillator which can generate the RF which shifted only predetermined frequency from the output of receiving amplifier 173a which amplifies the output signal of BPF171a, and this receiving amplifier 173a from wireless received frequency (925-960MHz band) (it is called "VCO for reception" below.) It consists of mixer 178a which mixes the RF signal generated from 176a and this VCO176a for reception, and the output of receiving amplifier 173a, and outputs the signal wave of predetermined frequency to a demodulator. The signal wave changed into predetermined frequency is inputted into a GSM demodulator etc. by GSM receive section 170a, and it restores to it to a voice grade signal, a digital signal, etc. by it.

[0026] Moreover, DCS transmitting section 160b by the transceiver section 102 is the same as that of GSM transmitting section 160a almost, except place [where radio frequencies differ]. That is, it consists of LPF168b which removes a frequency component higher than wireless transmit frequencies (1785MHz band) from the output of mixer 163b which mixes with the source signal inputted from the RF signal generated from VCO162b for transmission which can generate the RF of wireless transmit frequencies (1710-1785MHz band), and this VCO162b for transmission, the DCS modulator, etc., and is outputted, transmitting amplifier 166b which carries out power amplification of this mixer output, and this transmitting amplifier 166b. And the high frequency signal (DCS method) outputted from this DCS transmitting section 160b can be distributed to an antenna 103 side, and is emitted to space by the switching circuit and diplexer of the antenna switch 20 from an antenna 103.

[0027] Furthermore, the diplexer and switching circuit of the antenna switch 20 can distribute the high frequency signal by the DCS method received with the antenna 103 to a DCS method receiving-circuit side. BPF171b which permits passage of the frequency component which needs the DCS receiving circuit by the transceiver section 102, VCO176b for reception which can generate the RF which shifted only predetermined frequency from the output of receiving amplifier 173b which amplifies the output signal of BPF171b, and this receiving amplifier 173b from wireless received frequency (1805-1860MHz band), It consists of mixer 178b which mixes the RF signal generated from this VCO176b for reception, and the output of receiving amplifier 173b, and outputs the signal wave of predetermined frequency to a demodulator. The signal wave changed into predetermined frequency is inputted into a DCS demodulator etc. by this DCS receiving circuit, and it restores to it to a voice grade signal, a digital signal, etc. by it.

[0028] Thus, the antenna switch 20 concerning this operation gestalt ** While sending into GSM receive section 170a and DCS receive section 170b, without giving the RF signal received with the antenna 103 to the GSM transmitting section 160a and DCS transmitting section 160b side The RF signal transmitted by GSM receive section 170a and DCS receive section 170b GSM transmitting section 160a, Without giving the DCS transmitting section 160b side, send out to an antenna 103 and say that it emanates in the air. While the difference in a radio frequency band (a 900MHz band and 1.8GHz band) separates the function to portion out the RF signal which passes through a transmission line, and the RF signal received with the ** antenna 103 It has the function which compounds the RF signal of a different radio frequency band outputted from GSM transmitting section 160a (900MHz band) and DCS transmitting section 160b (1.8GHz band). In addition, these two functions are realized by the switching circuits SW1 and SW2 and Diplexer DP which constitute the antenna switch 20, respectively.

[0029] Next, the configuration of the antenna switch 20 is explained based on drawing 1 , drawing 3 - drawing 9 , etc. As shown in drawing 1 , the antenna switch 20 It consists of filters LPF1 and LPF2, switching circuits SW1 and SW2, a diplexer DP, etc. The antenna terminal ANT connected to the receiving terminal RX 2 connected to the transmitting terminal TX1 connected to GSM transmitting section 160a, the transmitting terminal TX2 connected to DCS transmitting section 160b, the receiving terminal RX 1 connected to GSM receive section 170a, and DCS receive section 170b, and an antenna 103, It has the control terminals VC1, VC2, VC3, and VC4 connected to a control section, and grounding terminal GND connected to the reference potential of the wireless section.

[0030] A filter LPF 1 is a capacitor C101, C102, C103, C104, C105, an inductor L101, and L1O2. It consists of a circuit element and LPF is constituted. It is the capacitor C102 connected to juxtaposition between the transmitting terminal TX1 to which GSM transmitting section 160a mentioned above is specifically connected, and the latter switching circuit SW1. And inductor L101 Capacitor C104 And inductor L102 It is located in a serial and is a capacitor C101 between the transmitting terminal TX1 and a ground. It connects. Moreover, capacitor C102 connected to juxtaposition And inductor L101 Capacitor C104 And inductor L102 Between a node and a ground, it is a capacitor

C103. It connects. Furthermore between a switching circuit SW1 side and a ground, it is a capacitor C105. It connects. Thus, the cut-off frequency of the filter LPF 1 constituted is set up so that a frequency component higher than the wireless transmit frequencies (900MHz band) by the GSM method can be removed. Spurious components, such as the secondary higher harmonic [3rd] contained in the sending signal outputted from GSM transmitting section 160a by this, etc. are removed.

[0031] A filter LPF 2 is a capacitor C201, C202, C203, C204, C205, an inductor L201, and L2O2. It consists of a circuit element and LPF is constituted like the filter LPF 1 mentioned above. Except place [where cut-off frequencies differ], it is the same as that of the above-mentioned filter LPF 1. It is the capacitor C202 connected to juxtaposition between the transmitting terminal TX2 to which DCS transmitting section 160b mentioned above is specifically connected, and the latter switching circuit SW2. And inductor L201 Capacitor C204 And inductor L202 It is located in a serial and is a capacitor C201 between the transmitting terminal TX2 and a ground. It connects. Moreover, capacitor C202 connected to juxtaposition And inductor L201 Capacitor C204 And inductor L202 Between a node and a ground, it is a capacitor C203. It connects. Furthermore between a switching circuit SW2 side and a ground, it is a capacitor C205. It connects. Thus, the cut-off frequency of the filter LPF 2 constituted is set up so that a frequency component higher than the wireless transmit frequencies (1.8GHz band) by the DCS method can be removed. Spurious components, such as the secondary higher harmonic [3rd] contained in the sending signal outputted from DCS transmitting section 160b by this, etc. are removed.

[0032] A switching circuit SW1 has the function which switches the signal path for inputting into GSM receive section 170a the input signal (GSM) which received the sending signal (GSM) which passed the filter LPF 1 from the signal path for outputting to the antenna terminal ANT, or the antenna 103. The switching circuit SW1 is located in the next step of a filter LPF 1, and is a coupling capacitor C1, C3, C4, bypass capacitors C2 and C5, a choke coil L1, INDATA L104, resistance R1, the high frequency switching diode (henceforth "diode") D1, and D2. It consists of a circuit element. Specifically in the input side connected to the output side of a filter LPF 1, it is a coupling capacitor C1. The end side is connected. This coupling capacitor C1 The coupling capacitor C3 mentioned later and C4 It has similarly the work which removes a dc component, and the work which takes impedance matching.

[0033] Coupling capacitor C1 In an other end side, it is diode D1. Choke coil L1 connected to the control terminal VC 1 while the anode side is connected The end side is connected. this choke coil L1 the direct current voltage which it has prevented that the RF signal which is set as the value which has an impedance high enough to the RF of a 900MHz band, and passed the filter LPF 1 flows into the control terminal VC 1 side, and also is supplied from the control terminal VC 1 -- diode D1 it is impressed by the anode side -- it works and has. Moreover, capacitor C2 which has an impedance low enough to the high frequency of a 900MHz band between the control terminal VC 1 and a ground It connects and has the work which misses the high frequency component which is going to flow into the control terminal VC 1 side to a ground side.

[0034] Diode D1 In a cathode side, it is an inductor L104. Coupling capacitor C3 The end side is connected, respectively. This inductor L104 In an other end side, it is diode D2. The anode side is connected and it is this diode D2. When turned on according to the potential condition of the control terminal VC 2, it is diode D2. Capacitor C5 connected between grounds the KASONODO side It is an inductor L104 so that a predetermined series resonant circuit can be constituted. The value is set up. In addition, the control terminal VC 2 and diode D2 Resistance R1 connected in between The control terminal VC 1 to the choke coil L1, diode D1, an inductor L104, and diode D2 The direct current which minds and flows toward the control terminal VC 2 is regulated. Moreover, diode D2 Between an anode side and the receiving terminal RX 1, it is a coupling capacitor C4. It connects.

[0035] if the control voltage of Lo level is applied to the control terminal VC 1 by connecting each circuit element in this way in a switching circuit SW1 at Hi level and the control terminal VC 2 -- coupling capacitor C1 from -- coupling capacitor C3 up to -- the transmission route of a between -- diode D1 It minds and is established in RF. On the other hand, when the control voltage of Hi level is applied to the control terminal VC 1 at Lo level and the control terminal VC 2, it is the receiving terminal RX 1 to the coupling capacitor C3. The transmission route between until Coupling capacitor C3 Inductor L104 connected Diode D2 Since a side becomes a high impedance, a coupling capacitor C3 to inductor L104 while even the coupling capacitor C4 which minds and is connected to the receiving terminal RX 1 is established in high frequency -- coupling capacitor C1 from -- coupling capacitor C3 up to -- a transmission route -- diode D1 It is intercepted. That is, when applying the control voltage of Lo level to the control terminal VC 1 at Hi level and the control terminal VC 2 when outputting a sending signal from GSM transmitting section 160a to the antenna terminal ANT, and inputting an input signal into GSM receive section 170a from the antenna terminal ANT, the control section by the microcomputer performs control which applies the control voltage of Hi level to the control terminal VC 1 at Lo level and the control terminal VC 2.

[0036] A switching circuit SW2 has the function which switches the signal path for inputting into DCS receive section 170b the input signal (DCS) which received the sending signal (DCS) which passed the filter LPF 2 from the signal

path for outputting to the antenna terminal ANT, or the antenna 103, and consists of the almost same configuration as the switching circuit SW1 mentioned above. The switching circuit S2 is located in the next step of a filter LPF 2, and is a coupling capacitor C6, C8, C9, a bypass capacitor C7, C10, a choke coil L3, INDATA L204, resistance R2, diode D3, and D4. It consists of a circuit element. Specifically in the input side connected to the output side of a filter LPF 2, it is a coupling capacitor C6. The end side is connected. This coupling capacitor C6 The coupling capacitor C8 mentioned later and C9 The coupling capacitor C1 mentioned above, C3, and C4 It has similarly the work which removes a dc component, and the work which takes impedance matching.

[0037] Coupling capacitor C6 In an other end side, it is diode D3. Choke coil L3 connected to the control terminal VC 4 while the anode side is connected The end side is connected. This choke coil L3 It is diode D3 about the direct current voltage which it has prevented that the RF signal which is set as the value which has an impedance high enough to the RF of a 1.8GHz band, and passed the filter LPF 2 flows into the control terminal VC 4 side, and also is supplied from the control terminal VC 4. It has the work impressed to an anode side. Moreover, capacitor C7 which has an impedance low enough to the high frequency of a 1.8GHz band between the control terminal VC 4 and a ground It connects and has the work which misses the high frequency component which is going to flow into the control terminal VC 4 side to a ground side.

[0038] Diode D3 In a cathode side, it is an inductor L204. Coupling capacitor C8 The end side is connected, respectively. This inductor L204 In an other end side, it is diode D4. The anode side is connected and it is this diode D4. When turned on according to the potential condition of the control terminal VC 3, it is diode D4. It is an inductor L204 so that a predetermined series resonant circuit can be constituted with the capacitor C10 connected between grounds the KASONODO side. The value is set up. In addition, the control terminal VC 4 and diode D4 Resistance R2 connected in between The control terminal VC 4 to the choke coil L3, diode D3, an inductor L204, and diode D4 The direct current which minds and flows toward the control terminal VC 4 is regulated. Moreover, diode D4 Between an anode side and the receiving terminal RX 2, it is a coupling capacitor C9. It connects.

[0039] if the control voltage of Lo level is applied to the control terminal VC 4 by connecting each circuit element in this way in a switching circuit SW2 at Hi level and the control terminal VC 3 -- coupling capacitor C6 from -- coupling capacitor C8 up to -- the transmission route of a between -- diode D3 It minds and is established in RF. On the other hand, when the control voltage of Hi level is applied to the control terminal VC 4 at Lo level and the control terminal VC 3, it is the receiving terminal RX 2 to the coupling capacitor C8. The transmission route between until Coupling capacitor C8 Inductor L204 connected Diode D4 Since a side becomes a high impedance, a coupling capacitor C8 to inductor L204 while even the coupling capacitor C9 which minds and is connected to the receiving terminal RX 2 is established in high frequency -- coupling capacitor C6 from -- coupling capacitor C8 up to -- a transmission route -- diode D3 It is intercepted. That is, when applying the control voltage of Lo level to the control terminal VC 4 at Hi level and the control terminal VC 3 when outputting a sending signal from DCS transmitting section 160b to the antenna terminal ANT, and inputting an input signal into DCS receive section 170b from the antenna terminal ANT, a control section performs control which applies the control voltage of Hi level to the control terminal VC 4 at Lo level and the control terminal VC 3.

[0040] The sending signal which Diplexer DP is constituted combining LPF and a high pass filter (henceforth "HPF"), and is outputted from GSM transmitting section 160a through a filter LPF 1 and a switching circuit SW1, It has the function to separate the frequency component passed to GSM receive section 170a and DCS receive section 170b from the function which compounds the sending signal outputted from DCS transmitting section 160b through a filter LPF 2 and a switching circuit SW2, and the input signal which received with the antenna 103.

[0041] Coupling capacitor C3 of a switching circuit SW1 The capacitor C108 connected to juxtaposition between the antenna terminals ANT, and inductor L106 It connects and is a coupling capacitor C3. Between grounds, it is a capacitor C107. It connects. This constituted LPF, and even if the high frequency signal of the 1.8GHz band by the DCS method is received by the antenna 103 by setting the cut-off frequency as a 1000MHz band, it flows into a switching circuit SW1 side, or it has controlled that the harmonic content exceeding a 1000MHz band leaks and appears in the antenna terminal ANT side.

[0042] Coupling capacitor C8 of a switching circuit SW2 Capacitor C207 connected to the serial between the antenna terminals ANT Capacitor C208 It connects and is a capacitor C207. And capacitor C208 Capacitor C209 connected to the serial between the node and the ground And inductor L206 It connects. This constituted HPF, and even if the high frequency signal of the 900MHz band by the GSM method is received by the antenna 103 by setting the cut-off frequency as a 1.7GHz band, it has controlled flowing into a switching circuit SW2 side.

[0043] The antenna switch 20 which consists of such circuitry As shown in drawing 4 - drawing 9 , it is the glass ceramic substrate (it is called a "substrate" below.) of 15 layers. It is constituted by the ceramic laminated structure which carried out the laminating of 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36. A capacitor C101, C102, C103, C104, and C105, C107, C108, C201, C202, C203, and C204, C205, C207, C208, C209, an inductor L101,

L102, L104 and L106, L201, L202, L204, and L206 It is made in the layer which carried out the laminating so that it might mention later. In addition, this ceramic laminated structure is formed by carrying out the laminating for example, of the dielectric ceramic sheet, and carrying out low temperature sintering. Moreover, although not illustrated in the typical sectional view of the antenna switch 20 shown in drawing 4 , the up space is established in the wrap metal cap by the substrate 22. The chip mounted in a substrate 22 by this is protected.

[0044] However, as shown in drawing 3 , a capacitor C1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 are mounted in a component side among the capacitors mentioned above using a chip, without making in the layer which carried out the laminating. That is, the components pad was prepared in the surface side equivalent to the 15th layer, and the configuration which solders chips, such as a capacitor, resistance, and diode, there is taken. thereby -- a coupling capacitor C1, 3, 4, 6, 8, and 9 the printed circuit board side of the dual band machine 100 which mounts the antenna switch 20 since it builds in the antenna switch 20 -- setting -- coupling capacitor C1 etc. -- It is not necessary to prepare by making it external separately. therefore, coupling capacitor C1 etc. -- since it is not necessary to prepare a mounting field according to an individual, reduction of components mark and reduction of a component-side product are enabled. Therefore, it is effective in the ability to contribute to small lightweight-ization of the dual band machine 100.

[0045] moreover, capacitor C1 etc. -- since it mounts in a component side using a chip, without making in the layer which carried out the laminating, especially, a coupling capacitor C1, 3, 4, 6, 8, and 9 are exchanged suitably, and can be changed. Thereby, antenna switch 20 simple substance can adjust the impedance matching of switching circuits SW1 and SW2 and filters LPF1 and LPF2. Therefore, the factor which serves as hindrance of the impedance matching of the capacity error and variation compared with the case where these coupling capacitors are made external is absorbable with adjustment of antenna switch 20 the very thing. that is, coupling capacitor C1 etc. -- since the situation where impedance matching cannot be appropriately taken by having made it external is avoided, it is avoidable from the increase of an insertion loss and the destabilizing factor of a RF property by this. Therefore, there is effectiveness as for which the RF property by the side of the dual band machine 100 is made to stability.

[0046] As shown in drawing 5 - drawing 9 , the substrate which constitutes the antenna switch 20 a capacitor C1 - C10, an inductor L1, L3, diode D1 - D4 etc. -- the order from the field side where components, such as a chip, are mounted -- circuit pattern 22a -- The substrate 22 which forms the ground patterns 22b and 22c is located. The substrates 23, 24, 25, 26, and 27 which form the Bahia halls 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, and 62 from a substrate 22 in the bottom of it are located, respectively. Moreover, the substrate 28 which forms the Bahia halls 41, 43, 44, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, and 62 in the bottom of this substrate 27 is located. The substrate 29 which furthermore forms the Bahia halls 41, 43, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, and 62 in the bottom of this substrate 28 is located.

[0047] And the lands 33a, 33b, 33c, 33d, and 33e formed in a substrate 33 through the Bahia halls 41, 43, 45, 46, 47, 72, 51, 71, 52, 54, 56, 57, 59, 61, and 62 formed in the substrates 30, 31, and 32 located in this substrate 29 bottom, Each buyer hole is connected to 33f, 33g, 33h, 33i, 33j, 33k, 33m, 33n, 33p, and 33q corresponding to each. In addition, the laminating of each substrate explained below is carried out to the order of substrates 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36 toward the substrate 22 bottom. Moreover, the pattern formed in each class so that it may explain below is connected by the Bahia halls 41-87 (expressed by each drawing bullet round head) between predetermined layers.

[0048] drawing 5 (A) Inductor L106 which constitutes Diplexer DP in the substrate 23 (drawing 5 (B)) located in the shown substrate 22 bottom it is -- pattern 23a is formed.

[0049] Drawing 5 (C) Inductors L201 and L202 which constitute a filter LPF 2 in the shown substrate 24 The patterns 24b (L201a) and 24c (L202a) which are parts are located.

[0050] Drawing 6 (D) Solid pattern 25a which constitutes a solid ground is formed in the shown substrate 25. The Bahia halls 41, 43, 45, 48, and 59 formed through substrates 23 and 24 from the substrate 22 of the maximum upper layer are connected to this solid pattern 25a. Moreover, one plate (C108a) and capacitor C208 of a capacitor C108 which constitute Diplexer DP in this substrate 25 The inductor L201 which pattern 25b which is one plate (C208a) is formed, and constitutes a filter LPF 2 further, and L202 The patterns 25c (L201b) and 25c (L202b) which are parts are also formed. Moreover, inductor L101 which constitutes a filter LPF 1 in a substrate 25 Pattern 25d (L101a) and the inductor L102 which are a part Pattern 25e (L102a) which is a part is also formed.

[0051] Drawing 6 (E) The plate (C108b) of another side of the capacitor C108 which constitutes Diplexer DP in the shown substrate 26, and capacitor C208 The plate (C208b) and capacitor C207 of another side Pattern 26a which is one plate (C207a) is formed. Moreover, inductor L101 which constitutes a filter LPF 1 Pattern 26b (L101b) and the inductor L102 which are pars intermedia Pattern 26c (L102b) which is a part is formed.

[0052] Drawing 6 (F) Inductor L104 which constitutes a switching circuit SW1 in the shown substrate 27 Pattern 27a (L104a) which is a part is formed. Moreover, inductor L204 which constitutes a switching circuit SW2 Pattern 27b (L204a) which is a part is formed. Capacitor C207 which furthermore constitutes Diplexer DP in a substrate 27 The

inductor L101 which pattern 27c which is the plate (C207b) of another side is formed, and constitutes a filter LPF 1, and L102 The patterns 27d (L101c) and 27d (L102c) which are the remainders are formed.
[0053] Drawing 7 (G) Inductor L104 which constitutes a switching circuit SW1 in the shown substrate 28 Inductor L204 which pattern 28a (L104b) which is the remainder is formed, and constitutes a switching circuit SW2 Circuit pattern 28b (L204b) which is the remainder is formed.
[0054] Drawing 7 (H) Capacitor C102 which constitutes a filter LPF 1 in the shown substrate 29 Pattern 29a and the capacitor C104 which are one plate (C102a) Pattern 29b which is one plate (C104a) is formed.
[0055] Drawing 7 (I) Capacitor C202 which constitutes a filter LPF 2 in the shown substrate 30 Pattern 30a and the capacitor C204 which are one plate (C202a) Pattern 30b which is one plate (C204a) is formed. Moreover, capacitor C102 which constitutes a filter LPF 1 in a substrate 30 A middle plate (C102b) and a middle capacitor C104 Pattern 30c which is a middle plate (C104b) is formed.
[0056] Drawing 8 (J) Capacitor C202 which constitutes a filter LPF 2 in the shown substrate 31 The plate (C202b) and capacitor C204 of another side Pattern 31a which is the plate (C204b) of another side is formed. Moreover, capacitor C102 which constitutes a filter LPF 1 Pattern 31b and the capacitor C104 which are the plate (C102c) of another side Pattern 31c which is the plate (C104c) of another side is formed.
[0057] Drawing 8 (K) Pattern 32a (L206) which is the inductor L206 which constitutes Diplexer DP is formed in the shown substrate 32.
[0058] Drawing 8 (L) Polar-zone 38a formed in the shown substrate 33 at the lowest layer, 38b, 38c, 38d, 38e, 38f, 38g, 38h, 38i, The lands 33a, 33b, 33c, 33d, 33e, 33f, 33g, 33h, 33i, 33j, 33k, 33m, 33n, 33p, and 33q which can connect with 38j, 38k, 38n, 38p, 38q, and 38r, respectively are formed.
[0059] Drawing 9 (M) Pattern 34a which is one plate (C107a) of the capacitor C107 which constitutes Diplexer DP is located in the shown substrate 34. Capacitor C201 which constitutes a filter LPF 2 Pattern 34b which is one plate (C201a), and capacitor C203 Pattern 34c and the capacitor C205 which are one plate (C203a) Pattern 34d which is one plate (C205a) is formed. Moreover, capacitor C101 which constitutes a filter LPF 1 Pattern 34e which is one plate (C101a), and capacitor C103 Pattern 34f and the capacitor C105 which are one plate (C103a) Pattern 34g which is one plate (C105a) is formed.
[0060] Drawing 9 (N) The plate (C107b) and capacitor C209 of another side of a capacitor C107 which constitute Diplexer DP in the shown substrate 35 Pattern 35a which is one plate (C209a) is located. Moreover, capacitor C201 which constitutes a filter LPF 2 A middle plate (C201b) and C203 A middle plate (C203b) and C205 Pattern 35b which is a middle plate (C205a) is formed. Moreover, capacitor C101 which constitutes a filter LPF 1 A middle plate (C101b) and capacitor C103 A middle plate (C103b) and a middle capacitor C105 Pattern 35c which is a middle plate (C105a) is formed.
[0061] Drawing 9 (O) Pattern 36a which is the plate (C209b) of another side of the capacitor C209 which constitutes Diplexer DP is formed in the shown substrate 36. Moreover, capacitor C201 which constitutes a filter LPF 2 Pattern 36b which is the plate (C201c) of another side, and capacitor C203 Pattern 36c and the capacitor C205 which are the plate (C203c) of another side Pattern 36d which is the plate (C205c) of another side is formed. Capacitor C101 which furthermore constitutes a filter LPF 1 Pattern 36e which is the plate (C101c) of another side, and capacitor C103 Pattern 36f and the capacitor C105 which are the plate (C103c) of another side Pattern 36g which is the plate (C105c) of another side is formed, respectively.
[0062] Moreover, in the antenna switch 20, from the need of mounting the dual band machine 100 in the substrate to constitute, in the substrate 36 located in this lowest layer, polar zone 38a, 38b, 38c, 38d, 38e, 38f, 38g, 38h, 38i, 38j, 38k, 38m, 38n, 38p, 38q, and 38r is formed, and the configuration of the perimeter of a flat surface is formed in irregularity at it. And polar zone 38a, 38b, 38c, 38i, 38j, 38k, and 38p corresponds to a grounding terminal, and in polar zone 38m and 38h, the transmitting terminals TX1 and TX2 and polar zone 38r and 38d correspond to the receiving terminals RX1 and RX2, and 38f of polar zone corresponds to the antenna terminal ANT, respectively. Furthermore, polar zone 38n, 38q, 38e, and 38g corresponds to the control terminals VC1, VC2, VC3, and VC4, respectively. Moreover, the flat-surface configuration of substrates 33, 34, and 35 enables internal wiring connected through the crevice by these polar zone 38a, 38b, 38c, 38d, 38e, 38f, 38g, 38h, 38i, 38j, 38k, 38m, 38n, 38p, 38q, and 38r by making the flat-surface configuration of a substrate 38 suit.
[0063] In addition, since the laminated structure of the antenna switch 20 is a glass ceramic substrate which consists of low-temperature baking, it can be calcinated at comparatively low temperature. thereby -- a conductor -- the low silver of resistance, copper, etc. can be used for a pattern. therefore, a conductor -- resistance is low, and since it is not necessary to use palladium, a tungsten, etc. which can moreover bear an elevated temperature, there is effectiveness which can also reduce the manufacturing cost of the antenna switch 20.
[0064] capacitor C101 mentioned above here etc. -- inductor L101 etc. -- the same -- a coupling capacitor C1, 3, 4, 6, 8, and 9 The configuration made all over a laminating may also be considered. however -- without it takes such a

configuration with the antenna switch 20 concerning this operation gestalt -- coupling capacitor C1 etc. -- it dares mount using a chip. This is because an error arises in the value of the capacitor which carried out interior and suitable impedance matching may be unable to be taken neither by gap (henceforth "laminating gap") of the direction of a flat surface of each substrate which may be produced at the time of a laminating, nor gap (henceforth "thickness gap") of the thickness of a ceramic sheet which carries out a laminating, if a coupling capacitor is made and carries out interior all over a laminating. This is an experimental result (1) shown in the degree which invention-in-this-application persons performed. - (4) It is carried out for whether being **.

[0065] Coupling capacitor C3 which connects between the switching circuits SW1 and Diplexers DP which are shown in drawing 1 When the configuration made all over a laminating is taken How many insertion losses (damping ratio of the sending signal outputted from the antenna terminal ANT to the sending signal inputted into the transmitting terminal TX1) of the antenna switch 20 whole change with laminating gap and thickness gaps The following (1) - (4) In the monograph affair, it checked by the computer simulation.

A. Coupling capacitor C3 Experiment which followed the layer to form (1) When 100 micrometers of laminating gaps arise in the direction of length and each width shown in drawing 3 , it is a coupling capacitor C3. Before laminating gap, what was 8pF decreased to 7.2pF after laminating gap, the insertion loss increased from 1.16dB to 1.19dB by this, and the 0.03dB increment was checked.

(2) When thickness gap arises 10%, it is a coupling capacitor C3. What was 8.4pF decreased to o'clock laminating gap-5% laminating gap +5% at 7.6pF at o'clock, the insertion loss increased to 1.18dB from 1.14dB by this, and the 0.04dB increment was checked.

B. Experiment which followed all layers (layer [1st] - the 15th layer) (3) When 100 micrometers of laminating gaps arose in the direction of length and each width shown in drawing 3 , the insertion loss increased from 1.396dB to 1.457dB, and it checked that the increment of the insertion loss by this was 0.088dB.

(4) When thickness gap arose 10% (from 840 micrometers to 764 micrometers), the insertion loss increased from 1.47dB to 1.73dB, and it checked that the increment of the insertion loss by this was 0.26dB.

[0066] (1) of a more than - (4) The next conclusion can be drawn by the experiment by the computer simulation. (1) And (2) An experimental result to coupling capacitor C3 When laminating gap and thickness gap arise to the layer to form, the increment in 0.07(0.03+0.04) dB is expected as an insertion loss. (3) And (4) When laminating gap and thickness gap arise from an experimental result to all layers (layer [1st] - the 15th layer), the increment in 0.348 (0.088+0.26) dB is expected as an insertion loss. therefore -- as a means to control such an insertion loss -- coupling capacitor C1 etc. -- even if it will produce an error in the capacity of capacitors other than a coupling capacitor by laminating gap etc. since the capacitor concerned can be changed suitably if mounted possible [changing] using a chip, impedance matching can be appropriately taken with antenna switch 20 simple substance including a part for the error. Thereby, the insertion loss by this factor can be decreased as much as possible. Therefore, it turns out that it is a means very effective when taking impedance matching to use and mount a chip in coupling-capacitor C1 grade.

[0067] As explained above, according to the antenna switch 20 concerning this operation gestalt The antenna terminal ANT connected to an antenna 103, and an antenna 103 and GSM transmitting section 160a, The switching circuits SW1 and SW2 which switch the signal path which connects between the signal path and antenna 103 which connect between DCS transmitting section 160b, and GSM receive section 170a and DCS receive section 170b, The coupling capacitor C3 which can be changed into the signal path which Diplexer DP intervenes between ** and connects between these Diplexer DP and switching circuits SW1 and SW2 at a serial, and C8 It intervenes. Thereby, they are Diplexer DP and a coupling capacitor C3, and C8. Since it is not necessary to prepare in the exterior of the antenna switch 20, the component-side products by the side of the dual band machine 100 which mounts the antenna switch 20 are reducible. Moreover, a coupling capacitor C3 and C8 Since it is antenna switch 20 simple substance and the impedance matching of switching circuits SW1 and SW2 and Diplexer DP can be taken appropriately the place which can be changed suitably, the RF property by the side of the dual band machine 100 can be made stability. Therefore, it is effective in the ability to contribute to small lightweight-ization, without spoiling the stability of actuation of the dual band machine 100 which can respond also with a different frequency band.

[0068] Moreover, the coupling capacitor C1 which can be changed into the signal path which according to the antenna switch 20 filters LPF1 and LPF2 intervene among the transmitting terminals TX1 and TX2 and switching circuits SW1 and SW2 which are connected to GSM transmitting section 160a and DCS transmitting section 160b, and connects between these filters LPF1 and LPF2 and switching circuits SW1 and SW2 at a serial and C6 It intervenes. Thereby, they are filters LPF1 and LPF2 and a coupling capacitor C1, and C6. Since it is not necessary to prepare in the exterior of the antenna switch 20, the component-side products by the side of the dual band machine 100 which mounts the antenna switch 20 are reducible. Moreover, a coupling capacitor C1 and C6 Since it is antenna switch 20 simple substance and the impedance matching of switching circuits SW1 and SW2 and Diplexer DP can be taken appropriately the place which can be changed suitably, the RF property by the side of the dual band machine 100 can

be made stability. Therefore, it is effective in the ability to contribute to small lightweight-ization further, without spoiling the stability of actuation of the dual band machine 100 which can respond also with a different frequency band.
[0069] Furthermore, although the configuration in which the filter for reception is located in the receiving terminals RX [RX1 and] 2 side connected to GSM receive section 170a and DCS receive section 170b was not taken with the antenna switch 20, for example, a SAW (Surface Acoustic Wave; surface acoustic waves) filter may be made to intervene between the receiving terminals RX1 and RX2 and switching circuits SW1 and SW2. The capacitor C4 which can be changed into the signal path which connects between these SAW filter and switching circuits SW1 and SW2 by this at a serial, and C9 Since it intervenes, an SAW filter is included, and they are a capacitor C4 and C9. It is not necessary to prepare in the exterior of the antenna switch 20. Therefore, the component-side products by the side of the dual band machine 100 which mounts the antenna switch 20 are reducible. Moreover, since a capacitor C4 and C9 are antenna switch 20 simple substances and can take appropriately the impedance matching of switching circuits SW1 and SW2 and Diplexer DP the place which can be changed suitably, they can make stability the RF property by the side of the dual band machine 100. Therefore, it is effective in the ability to contribute to small lightweight-ization further, without spoiling the stability of actuation of the dual band machine 100 which can respond also with a different frequency band.
[0070] In addition, although the antenna switch 20 by the operation gestalt mentioned above was equipped with a filter and two switching circuits for the dual band machine 100, respectively since it was a thing, this invention can apply these also to the antenna switch module with which only one line is equipped, without being restricted. Also in the antenna switch 20, for example, by taking the configuration only by the side of a GSM method except for DCS transmitting section 160b, DCS receive section 170b, the switching circuit SW2, and Filter LPF 2 by the side of a DCS method The receiving terminal RX 1 connected to the transmitting terminal TX1 connected to the antenna terminal ANT connected to an antenna 103 and GSM transmitting section 160a or GSM receive section 170a either A terminal, The switching circuit SW1 which switches the signal path which connects between GSM receive section 170a with the signal path and antenna 103 which connect between GSM transmitting section 160a with an antenna 103, Coupling capacitor C1 which can be changed into the signal path which a filter LPF 1 intervenes between ** and connects between this filter LPF 1 and switching circuit SW1 at a serial It becomes the intervening configuration. And thereby, they are a filter LPF 1 and a coupling capacitor C1. Since it is not necessary to prepare in the exterior of the antenna switch 20, the component-side products by the side of the mobile communication equipment which mounts the antenna switch 20 are reducible. Moreover, coupling capacitor C1 Since it is antenna switch 20 simple substance and the impedance matching of a switching circuit SW1 and a filter LPF 1 can be taken appropriately the place which can be changed suitably, the RF property by the side of mobile communication equipment can be made stability. Therefore, it is effective in the ability to contribute to small lightweight-ization, without spoiling the stability of actuation of mobile communication equipment.
[0071] Moreover, although the antenna switch 20 by the operation gestalt mentioned above explained the case where it was used for the dual band machine 100 If it is the case where it is used for the portable telephone of the specification which is not restricted to this in this invention and combines two or more frequency bands For example, you may be the case where it is used for the portable telephone of the triple band specification which three frequency bands can combination respond, and the portable telephone of the multi-band specification which four or more frequency bands can combination respond by one set of a portable telephone. And the same operation effectiveness as the above-mentioned antenna switch 20 is acquired also in these cases.
[0072] Furthermore, although the antenna switch 20 by the operation gestalt mentioned above explained the case where the combination of the frequency band of the dual band machine 100 was based on a GSM method and a DCS method If it is the combination of a different frequency band instead of what is restricted to this combination in this invention For example, the combination of a GSM method and a PCS (Personal Communication Services) method, The combination of an AMPS (Advanced Mobile Phone Services) method and a PCS method, You may be the combination of GSM and DECT (Digital European Cordless Telephone), the combination of a PDC method and a PHS (Personal Handy-phone System) method, etc.
[0073]
[Effect of the Invention] either of the receiving terminals connected to the antenna terminal connected to an antenna, the transmitting terminal connected to a sending circuit, or a receiving circuit in invention of claim 1 -- a filter circuit intervenes between the switching circuit which switches the signal path which connects between a terminal, the signal path and the antenna which connects between sending circuits with an antenna, and receiving circuits, and **, and the capacitor which can change into the signal path which connects between this filter circuit and switching circuit at a serial intervenes. That is, between a sending circuit, a receiving circuit, or an antenna and a switching circuit, the filter circuit which removes an unnecessary high frequency signal component intervenes, and the capacitor which can be

changed into a serial intervenes between this filter circuit and switching circuit further. Thereby, since it is not necessary to form a filter circuit and a capacitor concerned in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the capacitor concerned is an antenna switch module simple substance and can take the impedance matching of a switching circuit and a filter circuit appropriately the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment. Therefore, it is effective in the ability to contribute to small lightweight-ization, without spoiling the stability of actuation of mobile communication equipment.

[0074] In invention of claim 2, a transmitting-side filter circuit intervenes between the switching circuit which switches the signal path which connects between the transmitting terminal connected to a sending circuit, the signal path and antenna which connect between sending circuits with an antenna, and receiving circuits, and **, and the transmitting-side capacitor which can be changed into the signal path which connects between this transmitting-side filter circuit and switching circuit at a serial intervenes. Moreover, an antenna side filter circuit intervenes between the antenna terminal connected to an antenna, and the switching circuit concerned, and the antenna side capacitor which can be changed into the signal path which connects between this antenna side filter circuit and switching circuits at a serial intervenes. That is, between the transmitting-side filter circuit which removes an unnecessary high frequency signal component between a sending circuit and a switching circuit, and an antenna and a switching circuit, the antenna side filter circuit which removes an unnecessary high frequency signal component intervenes, and the transmitting-side capacitor which can be changed into a serial, and an antenna side capacitor intervene further, respectively between these transmitting-side filter circuits, an antenna side filter circuit, and a switching circuit. Thereby, since it is not necessary to form these transmitting-side filter circuits, an antenna side filter circuit, a transmitting-side capacitor, and an antenna side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since these transmitting-side capacitors and an antenna side capacitor are antenna switch module simple substances and can take appropriately the impedance matching of a switching circuit, and a transmitting-side filter circuit and an antenna side filter circuit the place which can be changed suitably, they can make stability the RF property by the side of mobile communication equipment. Therefore, it is effective in the ability to contribute to small lightweight-ization, without spoiling the stability of actuation of mobile communication equipment.

[0075] In invention of claim 3, in addition to invention of claim 2, a receiving-side filter circuit intervenes between the receiving terminal connected to a receiving circuit, and the switching circuit concerned, and the receiving-side capacitor which can be changed into the signal path which connects between this receiving-side filter circuit and switching circuit at a serial intervenes. That is, between a receiving circuit and a switching circuit, the receiving-side filter circuit which removes an unnecessary RF signal component intervenes, and the receiving-side capacitor which can be changed into a serial intervenes between this receiving-side filter circuit and switching circuit. Thereby, since it is not necessary to form these transmitting-side filter circuits, a receiving-side filter circuit, an antenna side filter circuit, a transmitting-side capacitor, a receiving-side capacitor, and an antenna side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are further reducible. Moreover, since these transmitting-side capacitors, a receiving-side capacitor, and an antenna side capacitor are antenna switch module simple substances and can take appropriately the impedance matching of a switching circuit, and a transmitting-side filter circuit, a receiving-side filter circuit and an antenna side filter circuit the place which can be changed suitably, they can make stability further the RF property by the side of mobile communication equipment. Therefore, it is effective in the ability to contribute to small lightweight-ization further, without spoiling the stability of actuation of mobile communication equipment.

[0076] In invention of claim 4, a synthetic separation circuit intervenes between two or more switching circuits which switch the signal path which connects between the signal path and antenna which connect between the antenna terminal connected to an antenna, and an antenna and two or more sending circuits, and two or more receiving circuits, and **, and the capacitor which can be changed into the signal path which connects between this synthetic separation circuit and two or more switching circuits at a serial intervenes. That is, between an antenna and two or more switching circuits, the synthetic separation circuit which may compound or separate the input signal inputted into the receiving circuit of the sending signal outputted from the sending circuit of arbitration or arbitration intervenes, and the capacitor which can be changed into a serial intervenes between this synthetic separation circuit and two or more switching circuits further. Thereby, since it is not necessary to form a synthetic separation circuit and a capacitor concerned in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side

of mobile communication equipment. It is effective in the ability to contribute to small lightweight-ization, without following, for example, spoiling the stability of actuation of the mobile communication equipment which can respond also with a different frequency band like a dual band machine.

[0077] In invention of claim 5, in addition to invention of claim 4, a transmitting-side filter circuit intervenes between two or more transmitting terminals and two or more switching circuits concerned which are connected to two or more sending circuits, and the transmitting-side capacitor which can be changed into the signal path which connects between this transmitting-side filter circuit and two or more switching circuits at a serial intervenes. That is, between two or more sending circuits and two or more switching circuits, the transmitting-side filter circuit which removes an unnecessary RF signal component intervenes, and the transmitting-side capacitor which can be changed into a serial intervenes further between this transmitting-side filter circuit and two or more switching circuits. Thereby, since it is not necessary to form the transmitting-side filter circuit concerned and a transmitting-side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the transmitting-side capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment. It is effective in the ability to contribute to small lightweight-ization further, without spoiling the stability of actuation of the mobile communication equipment which can respond also with a frequency band which follows, for example, is different like a dual band machine.

[0078] In invention of claim 6, in addition to invention of claim 4, a receiving-side filter circuit intervenes between two or more receiving terminals and two or more switching circuits concerned which are connected to two or more receiving circuits, and the receiving-side capacitor which can be changed into the signal path which connects between this receiving-side filter circuit and two or more switching circuits at a serial intervenes. That is, between two or more receiving circuits and two or more switching circuits, the receiving-side filter circuit which removes an unnecessary RF signal component intervenes, and the receiving-side capacitor which can be changed into a serial intervenes further between this receiving-side filter circuit and two or more switching circuits. Thereby, since it is not necessary to form the receiving-side filter circuit concerned and a receiving-side capacitor in the exterior of an antenna switch module, the component-side products by the side of the mobile communication equipment which mounts an antenna switch module are reducible. Moreover, since the receiving-side capacitor concerned is an antenna switch module simple substance and can take appropriately the impedance matching of a switching circuit and a synthetic separation circuit the place which can be changed suitably, it can make stability the RF property by the side of mobile communication equipment. It is effective in the ability to contribute to small lightweight-ization further, without spoiling the stability of actuation of the mobile communication equipment which can respond also with a frequency band which follows, for example, is different like a dual band machine.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the circuit diagram showing the configuration of the antenna switch module concerning 1 operation gestalt of this invention.
[Drawing 2] It is the block diagram showing the circuitry of the dual band machine using the antenna switch module concerning this operation gestalt.
[Drawing 3] It is the top view showing arrangement of the chip which constitutes the antenna switch module concerning this operation gestalt.
[Drawing 4] It is the typical sectional view showing the laminating condition of the antenna switch module concerning this operation gestalt.
[Drawing 5] the top view developing and showing the multilayer substrate which constitutes the antenna switch module concerning this operation gestalt for each class -- it is -- drawing 5 (A) - drawing 5 (C) Layer [15th] - the 13th layer is shown, respectively.
[Drawing 6] the top view developing and showing the multilayer substrate which constitutes the antenna switch module concerning this operation gestalt for each class -- it is -- drawing 6 (D) - drawing 6 (F) Layer [12th] - the 10th layer is shown, respectively.
[Drawing 7] the top view developing and showing the multilayer substrate which constitutes the antenna switch module concerning this operation gestalt for each class -- it is -- drawing 7 (G) - drawing 7 (I) Layer [9th] - the 7th layer is shown, respectively.
[Drawing 8] the top view developing and showing the multilayer substrate which constitutes the antenna switch module concerning this operation gestalt for each class -- it is -- drawing 8 (J) - drawing 8 (L) Layer [6th] - the 4th layer is shown, respectively.
[Drawing 9] the top view developing and showing the multilayer substrate which constitutes the antenna switch module concerning this operation gestalt for each class -- it is -- drawing 9 (M) - drawing 9 (O) Layer [3rd] - the 1st layer is shown, respectively.
[Description of Notations]
20 Antenna Switch Module
22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36 Glass ceramic substrate
100 Dual Band Machine
103 Antenna
160a GSM transmitting section (sending circuit)
160b DCS transmitting section (sending circuit)
170a GSM receive section (receiving circuit)
170b DCS receive section (receiving circuit)
ANT Antenna terminal
TX1, TX2 Transmitting terminal
RX1, RX2 Receiving terminal
SW1, SW2 Switching circuit
LPF1, LPF2 Filter (a filter circuit, transmitting-side filter circuit)
DP Diplexer (synthetic separation circuit)
C1, 3, 4, 6, 8, 9 Coupling capacitor (capacitor)

[Translation done.]

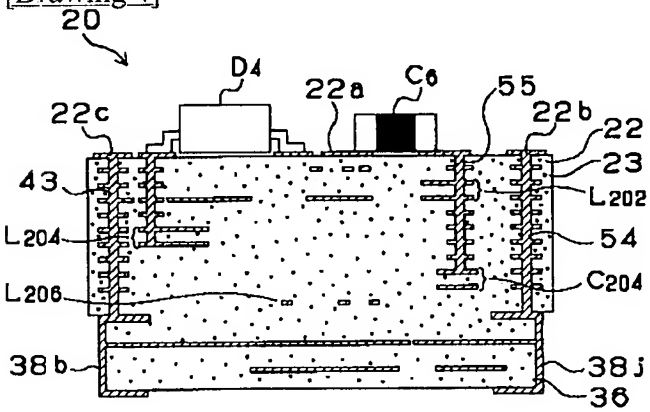
* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

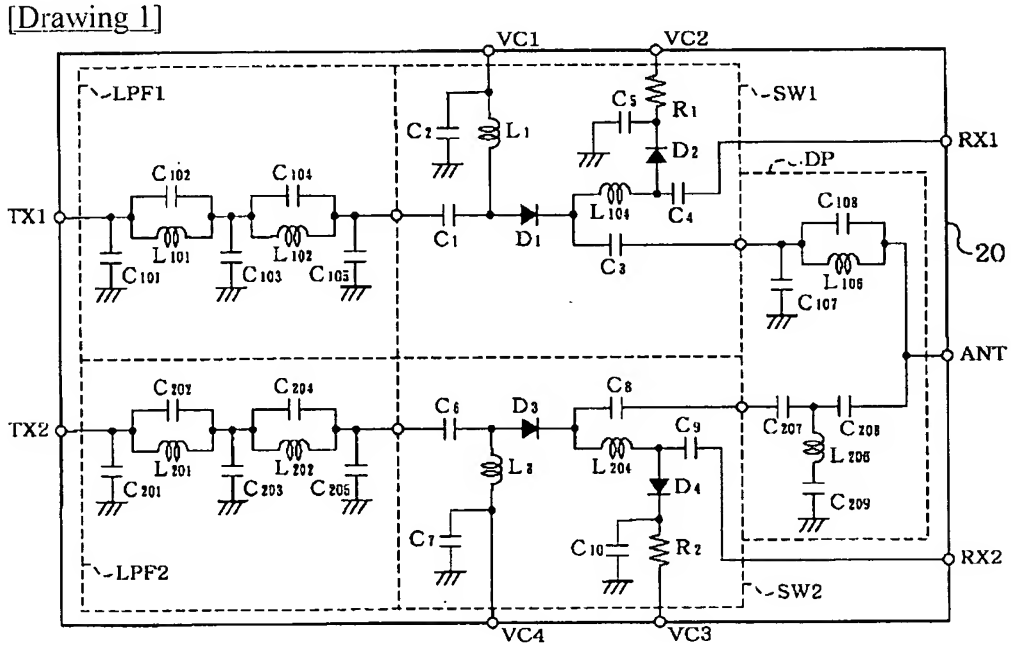
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

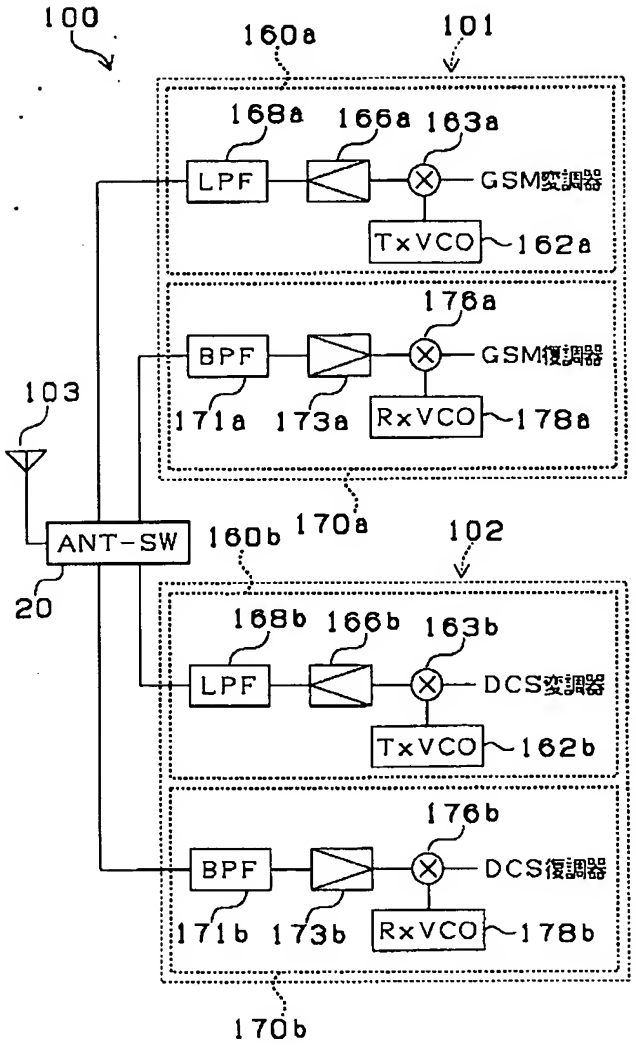
[Drawing 4]



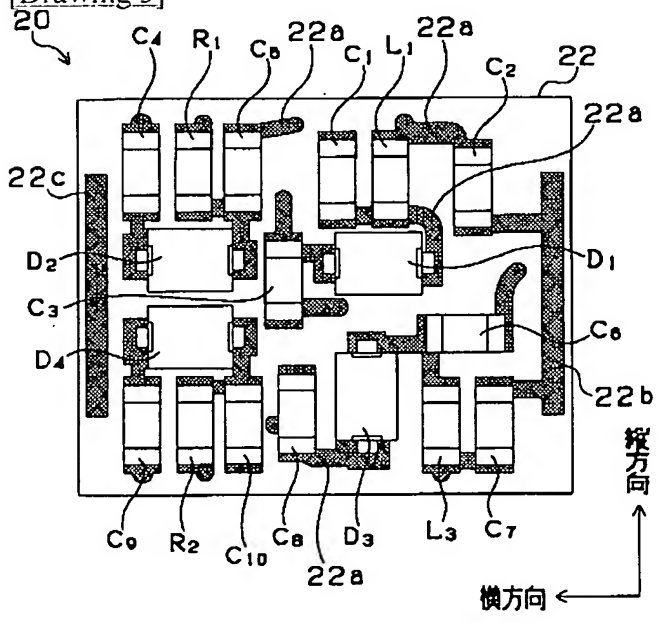
[Drawing 1]



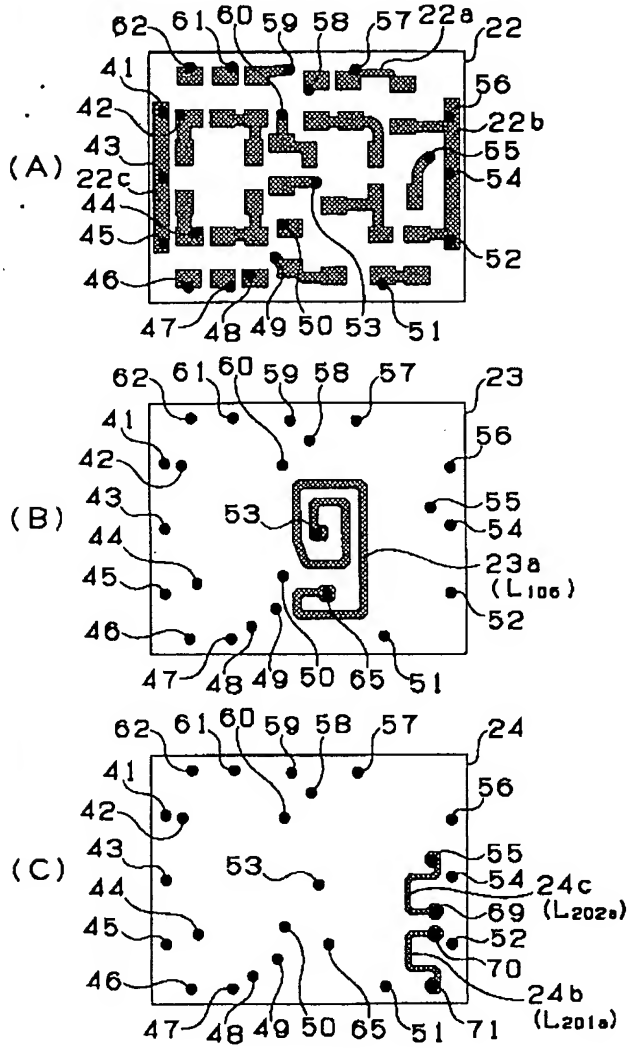
[Drawing 2]



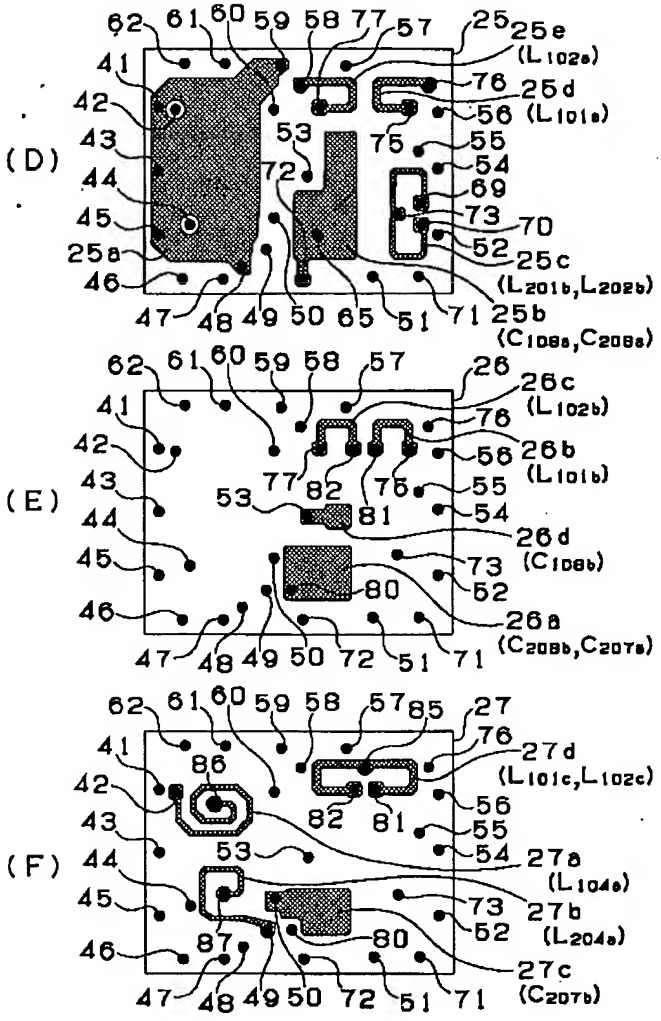
[Drawing 3]



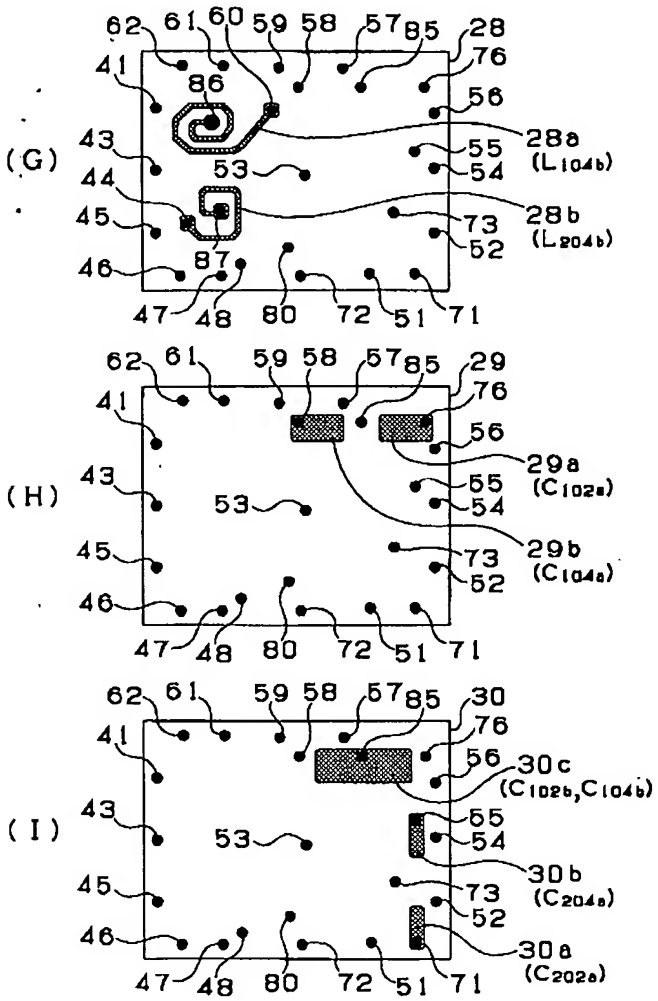
[Drawing 5]


(A)
62 61 60 59 58 57 22a 22
41
42
43
22c
44
45
46
56
22b
55
54
52
47 48 49 50 53 51
(B)
62 61 60 59 58 57 23
41
42
43
44
45
46
53
56
55
54
23a
(L106)
52
47 48 49 50 65 51
(C)
62 61 60 59 58 57 24
41
42
43
44
45
46
53
56
55
54 24c
69 (L202a)
52
70
24b
(L201a)
47 48 49 50 65 51 71

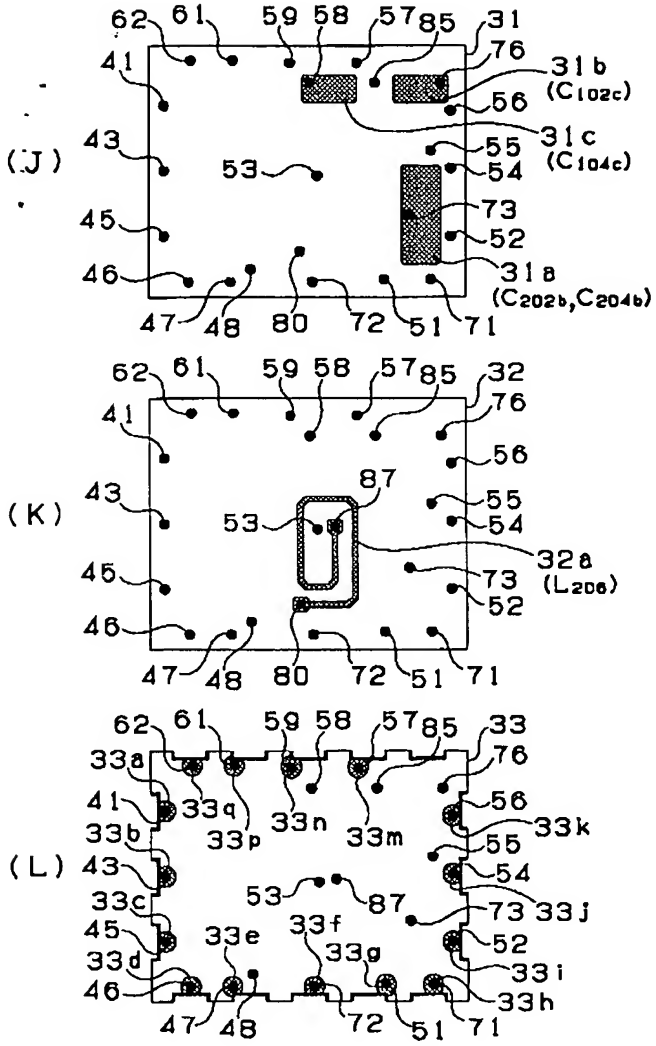
[Drawing 6]


(D)
62 61 60 59 58 77 57 25 25e (L102a)
41 42 43 44 45 25a 46
53 72 75 76 25d 56 (L101a) 55 54 69 73 70 52 25c (L201b,L202b)
47 48 49 50 65 51 71 25b (C108a,C208a)
(E)
62 61 60 59 58 57 26 26c (L102b) 76 56 26b (L101b) 55 54 26d (C108b) 73 52 26a (C208b,C207a)
41 42 43 44 45 46
77 82 75 53 81 80
47 48 49 50 72 51 71
(F)
62 61 60 59 58 57 85 27 76 27d (L101c,L102c) 56 55 54 27a (L104a) 73 52 27b (L204a) 27c (C207b)
41 42 43 44 45 46
86 82 81 53 87 80
47 48 49 50 72 51 71

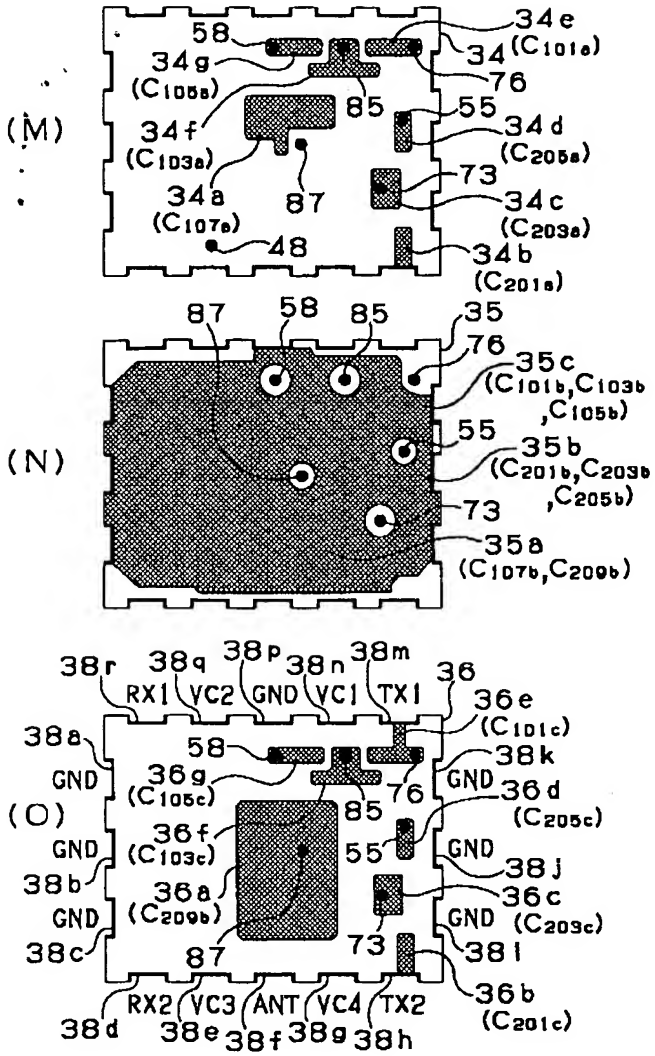
[Drawing 7]


(G)
62 61 60 59 58 57 85 28
41
86
76
56
43
28a
(L104b)
55
53
54
44
45
28b
(L204b)
73
52
87
46
47 48 80 72 51 71
(H)
62 61 59 58 57 85 29
41
76
56
43
29a
(C102a)
55
53
54
45
29b
(C104a)
73
52
46
47 48 80 72 51 71
(I)
62 61 59 58 57 85 30
41
76
56
30c
(C102b,C104b)
43
55
53
54
30b
(C204a)
45
73
52
46
30a
(C202a)
47 48 80 72 51 71

[Drawing 8]


(J)
62 61 59 58 57 85 31
41
76
31b
(C102c)
56
31c
(C104c)
55
54
43
53
73
45
52
46
31a
(C202b,C204b)
47 48 80 72 51 71
(K)
62 61 59 58 57 85 32
41
76
56
87
43
55
53
54
32a
(L206)
73
45
52
46
47 48 80 72 51 71
(L)
62 61 59 58 57 85 33
33a
76
41
33q
33n
56
33k
33b
33p
33m
55
43
54
53
87
73 33j
33c
33f
45
33e
52
33d
33g
33i
46
33h
47 48 72 51 71

[Drawing 9]



[Translation done.]